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**MOLECULAR BIOLOGY**  
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Great Clarendon Street, Oxford OX2 6DP

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It furthers the University's objective of excellence in research, scholarship,  
and education by publishing worldwide in

Oxford New York

Athens Auckland Bangkok Bogot  Buenos Aires Calcutta  
Cape Town Chennai Dares Salaam Delhi Florence Hong Kong Istanbul  
Karachi Kuala Lumpur Madrid Melbourne Mexico City Mumbai  
Nairobi Paris S o Paulo Singapore Taipei Tokyo Toronto Warsaw  
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Published in the United States  
by Oxford University Press Inc., New York

  The General Editors, 1997

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First published 1997  
Revised edition 2000

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A catalogue record for this book is available from the British Library

Library of Congress Cataloging in Publication Data  
(Data applied for)

ISBN 0 19 850673 2

Typeset by Market House Books Ltd, Aylesbury  
Printed in Great Britain by  
Butler & Tanner Ltd, Frome

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eral wave frequencies that an oscillator can generate, or to which a resonator can be tuned to respond. —modul adj.; modality *n*.

**modectin** a 57 kDa lectin present in the turnip-like root of the southern African plant, *Modectea digitata*. It is highly toxic to animals, its prime action being on the liver, and to animal cells in culture. It consists of two polypeptide subunits in disulfide linkage, the A (smaller) subunit being biologically indistinguishable from the A subunits of ricin and abrin. See also ribosome-inactivating protein.

**model** 1 a three-dimensional representation of an object, structure, etc., sized to be conveniently seen, handled, and studied, 2 a conceptual representation of a particular phenomenon, system, or set of experimental observations as an aid to understanding and as an object for test or for further experimentation, 3 an animal that, often as a result of mutation, mimics a pathological condition and can be used to study the pathogenesis of the condition. See also transgenic, 4 a mathematical representation of a particular phenomenon, system, or set of experimental observations as an aid to calculation and prediction, 5 to construct or create a model (def. 1, 2, 3). —modelled or (sometimes US) modeled adj.; —modelling or (sometimes US) modeling *n*.

**model system** any biological or biochemical system that is used for study because it is considered to be representative of one or more other (often more complex) systems in which similar phenomena occur or are believed to occur.

**modem** an electronic device, consisting of a combined modulator and demodulator, that is used to convert an output signal from one type of equipment (e.g. a computer) into a form suitable for input into another type, and vice versa. [From modulator-demodulator.]

**moderator** any substance that changes the rate of an enzymic or other reaction, either positively or negatively.

**modification** 1 (in biochemistry) see covalent modification, 2 (in genetics) any nonheritable change in the phenotype of an organism in response to variation of its environment; it includes host-controlled modification. Compare mutation.

**modification enzyme** any enzyme that effects covalent modification. See also restriction-modification system.

**modification gene** see restriction-modification system.

**modification methylase** a common name for any of the enzymes that methylate specific sites on a DNA molecule.

**modification-restriction system** an alternative name for restriction-modification system.

**modifier** an alternative term for effector.

**modifier gene** or modifying gene any gene that affects the phenotypic expression of a gene or genes at other loci.

**modify** 1 to alter the structure, character, activity, etc. of (something), 2 to convert a chemical compound into an analogue, especially by substitution. See also modification.

**modular primer** an unligated tandem arrangement of primers (usually two or three) used for the polymerase chain reaction and related experiments.

**modulating codon** any codon that controls the frequency with which a cistron or cistrons are transcribed.

**modulation** 1 adjustment or regulation of the degree or activity of something, 2 regulation of the frequency with which a cistron or cistrons are transcribed, 3 control of the activity of a regulatory enzyme by an effector, 4 (in physics) the process of changing the amplitude, frequency, or phase of a wave by combination with another wave.

**modulator** 1 something that modulates or brings about modulation, 2 any molecule that acts as an effector, 3 (in pharmacology) a ligand that increases or decreases the action of an agonist by combining with a distinct (allosteric) site on the receptor macromolecule.

**modulator protein** one provisional name for calmodulin.

**module** a standardized or self-contained part or unit of construction, especially one that can be used in alternative combinations with others; e.g. one of a set of such assemblies of

## molar absorption coefficient

electronic components that comprise a larger piece of equipment. See also Appendix E. —molar adj.

**moesin** abbr. for membrane-organizing extension spike protein; a protein, isolated from bovine uterus, with one domain similar to one in ezrin, band 4.1, and related proteins. Moesin occurs in many cell types and tissues and is involved in connections of major cytoskeletal structures to the plasma membrane. Example from human: database code MOES\_HUMAN, 576 amino acids (67.61 kDa).

**Moffitt-Yang equation** or **Moffitt equation** a phenomenological equation, related to the Drude equation, that describes the anomalous variation of optical rotatory dispersion with wavelength shown by polypeptides containing helical sections. It is used to provide an estimate of the alpha-helical content of polypeptides and proteins. If  $\lambda$  is the wavelength of observation and  $[\alpha]_0$  is the reduced mean residue rotation at that wavelength,

$$[\alpha]_0 = \{a_0 \lambda_0^2 / (\lambda^2 - \lambda_0^2)\} + \{b_0 \lambda_0^4 / (\lambda^2 - \lambda_0^2)^2\},$$

where  $a_0$ ,  $b_0$ , and  $\lambda_0$  are empirical constants;  $a_0$  is a function of contributions to the optical rotation from both the helix and the residue side-chains, as well as from the solvent, and  $b_0$  and  $\lambda_0$  are related principally to the amount of helical structure in the molecule. A value of  $\lambda_0$  is chosen to give the best straight line when  $[\alpha]_0(\lambda^2 - \lambda_0^2)$  is plotted against  $1/(\lambda^2 - \lambda_0^2)$ , a good fit usually being obtained if  $\lambda_0 = 212$  nm when  $\lambda = 350$ – $600$  nm. The slope of this line,  $b_0 \lambda_0^4$ , gives a value of  $b_0$ , whence by reference to the values found for nonhelical and fully helical synthetic polypeptides an estimate may be made of the alpha-helical content of a polypeptide or protein under investigation. [After William E. Moffitt (1925–58), British physical chemist and Jen Tsi Yang (1922–95), who formulated it in 1956.]

**Mohr pipette** a cylindrical pipette calibrated for delivery from the zero mark to a particular chosen graduation mark. [After Carl Friedrich Mohr (1806–1879), German chemist.]

**Mohr's salt** ammonium ferrous sulfate; di-ammonium iron(II) sulfate hexahydrate;  $(\text{NH}_4)_2\text{SO}_4 \cdot \text{FeSO}_4 \cdot 6\text{H}_2\text{O}$ .

**moiety** either of two, usually distinctive, component parts of a complex molecule; e.g. the steroid and saccharide moieties of a cardiac glycoside.

**mol** symbol for mole.

**mol.** abbr. for 1 molecular, 2 molecule.

**μmol** symbol for micromole.

**molar** 1 denoting the concentration of a solute (or a solution as a whole) expressed as the amount of substance of the solute divided by the mass of solvent. It is measured in moles per kilogram, 2 denoting an amount-of-substance concentration measured in such terms. Compare molar.

**molarity** symbol: *m* or *b*; a measure of concentration expressed as the number of moles (of a specified solute) per kilogram of solvent. Molarity is independent of temperature. See also molar.

**molar** 1 denoting an extensive physical quantity that is measured per mole (of a specified substance). It is usually denoted by the subscript *m* in the symbol; e.g. molar volume is the volume of one mole of a substance, and the symbol is  $V_m$ . Compare specific, 2 denoting an intensive physical quantity that is measured per mole (of a specified substance); i.e. divided by concentration. Use of the term molar in this sense is no longer recommended, except in the terms molar absorption coefficient and molar conductivity, 3 denoting the concentration of a solute (or a solution as a whole), expressed as the amount of substance of the solute divided by the mass of the solution. The recommended units are moles per litre but the convenient symbols *M* and *m* are frequently used. Compare molar.

**molar absorptance index** a former name for molar absorption coefficient.

**molar absorption coefficient** either the molar decadic absorption coefficient (symbol:  $\epsilon$ ) or the molar Napierian absorption coefficient (symbol:  $\kappa$ ); these are, respectively, the decadic absorbance or the Napierian absorbance of a substance, or of a

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**coupling factor**

is proportional to the magnitude of the spin-spin coupling constant.

**coupling factor** *abbr.*: CF; *archaic term* for either 1 any of the proteins functioning in the coupling of ATP synthesis to electron transport in mitochondria. CF1-CF4 are obsolete names for the  $\alpha$ - $\delta$  subunits of mitochondrial H<sup>+</sup>-transporting ATP synthase. 2 any of the proteins required for the coupling of ATP synthesis to the photoinduced electron transport in chloroplasts during photosynthesis. The concept has been replaced by the chemiosmotic coupling hypothesis.

**coupling membrane** any biological membrane in which energy-yielding and energy-requiring biochemical processes occur together.

**covalence or covalency** nonionic valence between two atoms in a chemical compound, characterized by their sharing of one or more electrons. —*covalent adj.*

**covalent bond** a chemical bond formed between two atoms in a molecule by the sharing of electrons, usually in pairs, by the bonded atoms.

**covalent catalysis** the catalysis of any reaction in which the substrate is modified by forming a covalent bond with the catalyst (enzyme).

**covalent chromatography** any technique of column chromatography in which the substance of interest binds covalently with groups, e.g. —SH groups, on the support medium and is subsequently displaced by an appropriate reagent.

**covalent (closed) circle (of DNA) or covalently closed circular DNA or closed double-stranded DNA** *abbr.*: cccDNA; any double-stranded DNA molecule that is circular (but not necessarily geometrically circular) and in which both polynucleotide strands are completely continuous. *Compare* Hershey circle, open circle.

**covalent modification** any of a diverse group of processes in which the initially synthesized structures of biopolymers, especially enzymes, procenzymes, or structural macromolecules, are enzymically modified by the breakage of covalent bonds or the addition of new covalently linked groups. It includes post-translational modification. The term may sometimes be used in the more restricted sense of reversible interconversion of active and inactive forms of certain metabolic enzymes or other proteins by sets of control enzymes, often by phosphorylation-dephosphorylation.

**covariance** a measure of the association between two variables. For  $n$  pairs of values of two random variables,  $x$  and  $y$ , this is given by:

$$\text{Cov.}(x,y) = (x - \bar{x})(y - \bar{y}) / (n - 1)$$

where  $\bar{x}$  and  $\bar{y}$  are the means of the populations of  $x$  and  $y$ , respectively. *Compare* correlation coefficient, regression coefficient, variance.

**covariation** any of the codons in a given gene that may concomitantly vary, so resulting in favourable mutations or in mutations leading to amino-acid substitutions that have little or no effect. [From concomitantly variable codon.]

**covirus** any virus that exists as two or more separate particles all of which must be present together in the host organism for the complete replication cycle of the virus to occur.

**covelume** the amount by which the apparent volume of a molecule exceeds the sum of the volumes of the constituent atoms. It is usually 13–14 cm<sup>3</sup> mol<sup>-1</sup> for protein molecules.

**cozymase** originally, the heat-stable, diffusible fraction of a crude aqueous extract of brewers' yeast that, if added to the heat-labile, nondiffusible fraction (zymase), would enable the alcoholic fermentation of glucose to occur in a cell-free system. The term was subsequently applied to one particular substance present in that fraction, now known as nicotinamide adenine dinucleotide.

**C<sub>2</sub> pathway** an alternative name for reductive pentose phosphate cycle.

**C<sub>4</sub> pathway** an alternative name for Hatch-Slack pathway.

**CPBA** *abbr.* for competitive protein-binding assay.

**C-reactive protein**

**CPE** *abbr.* for cytopathic effect.

**C peptide** 1 a the inactive polypeptide excised from proinsulin during its conversion to insulin. It contains 31 amino-acid residues in the human but shows greater species variability in both length and amino-acid sequence than does insulin. The structure of porcine C-peptide is (including the flanking basic residues):

RREAQNPPQAQAVELGGGLGGLQALALEGPPQKR.

It is released into the bloodstream concomitantly with insulin, hence the blood level is useful in evaluation of  $\beta$ -cell function. 2 that segment of the amino-acid sequence of proinsulin lying between the two residues destined to become respectively the C-terminal residue of the B chain of insulin and the N-terminal residue of the A chain. It consists structurally of the above polypeptide plus two flanking pairs of basic residues. C peptide is named from connecting peptide, and perhaps also because, after A (chain) and B (chain), C (peptide) represents alphabetically the third major structural component of proinsulin. 2 an alternative name for C fragment (of  $\beta$ -lipotropin) (see lipotropin).

**CpG island** a region of 1–2 kb containing a high density of methylated cytosine residues and occurring immediately 5' to G residues, i.e. in the sequence CpG. CpG islands are frequently found in animal genomes at the 5' end of genes. In plants the methylated sequence is ...CpNpGp... where N can be any base. Methylation of DNA is a heritable phenomenon that reduces gene expression, probably by increasing the binding of a repressor. CpG islands are a site of high mutational frequency because spontaneous deamination of the methylated cytosine gives thymine, which is not recognized by DNA repair enzymes.

**C<sub>3</sub> plant** any plant in which fixation of carbon dioxide occurs predominantly by the reductive pentose phosphate cycle; i.e. by incorporation initially into the three-carbon compound 3-phosphoglycerate.

**C<sub>4</sub> plant** any plant in which fixation of carbon dioxide occurs predominantly by the Hatch-Slack pathway; i.e. by incorporation initially into the four-carbon compound oxaloacetate. Such plants are found usually in semiarid conditions with high light levels. They include sugar cane, corn (maize), and many weeds.

**cpm or c.p.m.** *abbr.* for counts per minute.

**Cr** *symbol* for chromium.

**Crabtree effect** the inhibition of respiration by glycolysis. The inhibition is small and occurs only in a few types of cells that possess a high glycolytic capacity, e.g. ascites tumour cells and other neoplastic tissues, renal medulla, leukocytes, and cartilage. *Compare* Pasteur effect.

**Craig apparatus** the most widely used type of apparatus for carrying out countercurrent distribution experiments. The earlier version (1944) was constructed of metal and the later version (1949) was of modular design and constructed of glass. [After Lyman Creighton Craig (1906–74).]

**crambin** a protein obtained from seeds of *Crambe abyssinica*. It comprises 46 amino acids, has a molecular mass of 4.73 kDa (database code CRAM\_CRAAB), and is remarkable for its highly ordered crystals and very high resolution. Its 3-D structure is known.

**cranin** a form of dystroglycan.

**CRE** *abbr.* for cyclic AMP response element; a sequence, GTGACGT(A/G)(A/G),

that is present in many viral and cellular promoters. When it binds CREB protein, transcription of the genes regulated by such a promoter is turned on.

**C-reactive protein** *abbr.*: CRP; an acidic, crystallizable, heat-sensitive protein of  $\approx 118$  kDa that is detectable in human or monkey blood serum early in the course of various infections or when there is inflammation, tissue damage, or necrosis. One of the so-called acute phase proteins, it is normally un-

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